of at least one nucleotide fiber to at least one other nucleotide fiber or between at least one nucleotide fiber and at least one specific sequence or domain-recognizing complexing agent.

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~~30.~~ (Twice Amended) A method according to Claim ~~28~~, comprising mixing nucleotide fibers and components together and allowing them to self-assemble into a network by means of specific molecule interactions.

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~~31.~~ (Twice Amended) A method according to Claim ~~28~~, comprising forming junctions between nucleotide fibers and at least one molecule, cluster of atoms or molecules or particles, said molecule clusters or particles serving as an electronic component in the network.

Please add new claim 32 as follows:

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--32. A method according to claim 12, wherein said functionalization is achieved by forming on said nucleotide fiber at least one nucleation center from which said substance or particles are grown.--

REMARKS

Claims 1-17 and 19-32 are pending. By the Office Action, claims 1-31 are rejected. By this Amendment, claim 18 is canceled, claims 1, 3, 4, 7, 10, 11, 13-15, 17, 19, 20, 22-24, 26 and 28-31 are amended, and claim 32 is added. No new matter is added.

The attached Appendix includes marked-up copies of each rewritten claim (37 C.F.R. §1.121(c)(1)(ii)).

Applicants appreciate the courtesies shown to Applicants' representatives by Examiner Jackson in the May 21 telephone interview. Applicants' separate record of the substance of the interview is incorporated into the following remarks.

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I: §102/§103 Rejection Over Mirkin

Claims 1-16, 19 and 28-31 are rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Mirkin et al. (Mirkin). Applicants respectfully traverse the rejection.

Claims 1-16, 19 and 28-31 are directed to an electrical network and a method for making an electrical network wherein the electrical network comprises at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to the nucleotide fiber or complexed continuously along the nucleotide fiber to form at least one electric or electronic component or a conductor.

The specification clearly states that a nucleotide fiber thus coated is a functionalized fiber. Page 6, lines 21-25, of the current specification clearly define a functionalized fiber as a nucleotide fiber that has been chemically or physically modified or attached with substances, clusters of atoms or molecules or particles deposited on the fiber which impart electric or electronic properties to the fiber or a part thereof. The molecules coating the functionalized fiber are in direct contact with one another. See, for example, Figures 3A, 4 and 5.

In one non-limiting example, the functionalized fiber is obtained by exposing the fibers to a solution of silver ions under conditions suitable for loading of the silver ions onto the nucleic acid fiber. The nucleotide fiber is thus overlaid with a continuous stretch of a conducting substance, i.e., silver ions, allowing electricity to flow along the functionalized fiber.

In contrast, Mirkin discloses a method for assembling colloidal gold nanoparticles into macroscopic aggregates. See the Abstract and Figure 1. In Mirkin's method, one portion of gold particles is coated with DNA oligonucleotides having sticky ends that are not

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complementary to each other. A second portion of gold particles are coated with DNA oligonucleotides having sticky ends that are complementary to the sticky ends of the DNA coated onto the first portion of gold particles. When the two portions are mixed together, the complementary sticky ends of the coated gold particles self-assemble into aggregates. These aggregates are not identical to the coated nucleotide fiber claimed in claims 1-16, 19 and 28-31.

As opposed to being a continuous nucleotide fiber, the DNA oligonucleotides of Mirkin are interrupted by the gold particles to which they are attached, and the gold particles themselves are not in direct contact with one another. As a result, it is inherently impossible for the aggregates of Mirkin to conduct electricity because the gold particles are not in direct contact with one another, and do not form a continuous stretch of conducting elements.

In support of this fact, inventors Yoav Eichen and Uri Sivan of the present invention conducted experiments to see if electricity can be carried along a nucleotide fiber when the metal particles attached thereto are not in direct contact with one another. As is evident in the enclosed Declarations, electricity cannot be carried along a nucleotide fiber when metal particles attached thereto do not form a continuous stretch along the nucleotide fiber. Thus, the aggregates of Mirkin, as illustrated in Fig. 1, are not identical to the coated nucleotide fibers claimed in claims 1-16, 19 and 28-31 of the present invention. In particular, the aggregates of Mirkin, in which the gold particles are not in direct contact with one another, cannot conduct electricity.

Applicants submit that Mirkin does not teach or suggest every feature of the claimed invention. In particular, Mirkin does not teach or suggest at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to said nucleotide fiber or complexed therewith continuously along said fiber to form at least one electric or electronic component or conductor. Further,

Mirkin does not provide motivation for one of ordinary skill in the art to modify the disclosed coated gold particle aggregates to achieve the claimed coated nucleotide fiber. Still further, Mirkin teaches away from the claimed invention by requiring gold particles coated with DNA oligonucleotides. These coated gold particles cannot come into direct contact with each other, and thus cannot conduct electricity.

For at least these reasons, Applicants submit that claims 1-16, 19 and 28-31 are not anticipated by Mirkin, and that the Office Action has not established a *prima facie* case of obviousness. Thus, claims 1-16, 19 and 28-31 are patentable over Mirkin. Reconsideration and withdrawal of the rejection are respectfully requested.

II. §103 Rejection Over Mirkin and Hopfield

Claims 1-16, 19 and 21-31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Mirkin in view of U.S. Patent No. 5,063,417 to Hopfield (Hopfield). Applicants respectfully traverse the rejection.

Claims 1-16, 19 and 21-31 are directed to an electrical network and a method for making an electrical network wherein the electrical network comprises at least one nucleotide fiber defining the network's geometry, and one or more substances, molecules, clusters of atoms or molecules or particles bound to the nucleotide fiber or complexed continuously along the nucleotide fiber to form at least one electric or electronic component or a conductor.

As discussed above, Mirkin does not teach or suggest every feature of the claimed invention. Further, the aggregates of Mirkin cannot conduct electricity. The Office Action indicates that Hopfield teaches how to connect chains of molecular elements to connection pads for input and output. However, combining the teachings of Mirkin and Hopfield by connecting the aggregates of Mirkin to connection pads for input and output does not achieve the claimed invention.

Neither Mirkin nor Hopfield, alone or in combination, teach or suggest every feature of the claimed invention. In particular, neither Mirkin nor Hopfield teach or suggest a nucleotide fiber that defines a network's geometry and particles complexed continuously along the nucleotide fiber to form at least one electric or electronic component or a conductor. Further, neither Mirkin nor Hopfield provide motivation for one of ordinary skill in the art to combine the two references to achieve the claimed inventions.

For at least these reasons, Applicants submit that it would not have been obvious to one of ordinary skill in the art to modify the disclosure of Mirkin, in view of Hopfield, to practice the invention claimed in claims 1-16, 19 and 21-31, and that the Office Action has not established a *prima facie* case of obviousness. Thus, claims 1-16, 19 and 21-31 are patentable over Mirkin and Hopfield, alone or in combination. Reconsideration and withdrawal of the rejection are respectfully requested.

III. §112 Rejection

Claims 17, 18 and 20 are rejected under 35 U.S.C. §112, first paragraph, as allegedly not being enabled by the specification. Applicants respectfully traverse the rejection.

Claim 18 is canceled, thus rendering the rejection of this claim moot.

The Examiner has indicated both in the Office Action and in the May 21 personal interview that the rejection will be maintained unless Applicants submit evidence of working devices. However, a working example is not required in order to satisfy the enablement requirement of §112, first paragraph, which only requires that the claimed invention is sufficiently enabled by the specification so that one skilled in the art can make or use the invention without undue experimentation.

MPEP §2164.02 indicates that compliance with the enablement requirement of 35 U.S.C. §112, first paragraph, does not turn on whether an example is disclosed. MPEP §2164.02 indicates that an example may be "working" or "prophetic," and that a

prophetic example describes an embodiment of the invention based on predicted results rather than work actually conducted or results actually achieved. Applicants submit that the claimed invention is sufficiently enabled by the present specification so that one skilled in the art can make or use the invention without undue experimentation.

On page 28, line 10 - page 30, line 18, Applicants disclose how to make a network in which an n/p diode can be made according to the invention. In particular, the specification discloses forming an n/p junction diode by first binding an n-type substance (which is defined in the specification as a polymer having an electron surplus) to a first oligonucleotide. Next, Applicants disclose binding a p-type substance (which is defined in the specification as a polymer having an electron deficiency) to a second oligonucleotide. Next, Applicants disclose hybridizing the DNA nucleotides to one another, thereby bringing the p-type and n-type substances together, forming an n/p junction.

This functionalized wire is then connected to electrodes. By definition, an n/p-type junction that is attached to electrodes is a working diode, made of semiconductor polymer material, that has the ability to conduct current. The diode of the present invention is illustrated in Figure 5. This is described sufficiently in the present specification to enable one of ordinary skill in the art to make or use the claimed diode without undue experimentation.

On page 28, line 10 - page 30, line 18, Applicants also disclose a network in which a bipolar transistor can be made according to the invention. In particular, the specification discloses binding a p-type substance to a first nucleotide, an n-type substance to a second nucleotide, a p-type substance to a third nucleotide, and hybridizing the nucleotides together. This functionalized wire is connected to electrodes. The result is a pnp bipolar transistor. The bipolar transition of the invention is illustrated in Figure 5. One of ordinary skill in the art would understand that there are two major types of bipolar transistors, pnp and npn bipolar transistors. This is described sufficiently in the present specification to enable one of

ordinary skill in the art to make or use the claimed bipolar transistor without undue experimentation.

The Examiner indicated in the May 21 personal interview that the rejection will be maintained because if the claimed invention worked, Applicants would have a working example. However, Applicants are not required to limit the claimed invention to what has been found to work or actually reduced to practice. In *In re Goffe*, 542 F.2d 564, 567, 191 USPQ 429, 431 (CCPA 1976), the court stated:

> [T]o provide effective incentives, claims must adequately protect inventors. To demand that the first to disclose shall limit his claims to what he has found will work or to material which meet the guidelines specified for "preferred" materials in a process such as the one herein involved would not serve the constitutional purpose of promoting progress in the useful arts.

MPEP §2164.04 indicates that a specification disclosure which contains a teaching of the manner and process of making and using an invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as being in compliance with the enablement requirement of 35 U.S.C. §112, first paragraph, unless there is a reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support. *In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971).

As stated by the court, "it is incumbent upon the Patent Office, whenever a rejection on this basis is made, to explain *why* it doubts the truth or accuracy of any statement in a supporting disclosure and to back up assertions of its own with acceptable evidence or reasoning which is inconsistent with the contested statement. Otherwise, there would be no need for the applicant to go to the trouble and expense of supporting his presumptively accurate disclosure." 439 F.2d at 224, 169 USPQ at 370. Applicants submit that the Office

Action has not provided evidence or reasoning why the truth and accuracy of the supporting disclosure is in doubt.

For at least these reasons, Applicants submit that claims 17 and 20 are enabled by the specification. Reconsideration and withdrawal of the rejection are respectfully requested.

Applicants would like to bring to the Examiner's attention the fact that Applicants' invention was published in the prominent peer-reviewed journal Nature in 1998. This journal article was submitted in the May 5, 2000, Information Disclosure Statement, which was acknowledged by the Examiner in March 2001. The Mirkin article was published in the same journal in 1996. Clearly, publication in this respectable journal is indicative of the uniqueness of the present invention.

In view of the foregoing amendments and remarks, Applicants submit that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-17 and 19-31 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Joel S. Armstrong
Registration No. 36,430

JAO:PAC/ja

Attachments:
Appendix
Declaration (2)

Date: May 28, 2002

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

APPENDIX

Changes to Claims:

Claim 18 is canceled.

Claim 32 is added.

The following is a marked-up version of the amended claims:

1. (Amended) An electric network comprising:

- at least one nucleotide fiber ~~comprising a nucleotide chain~~ defining the network's geometry; and

- one or more substances, molecules, clusters of atoms or molecules or particles bound ~~thereto~~ to said nucleotide fiber or complexed therewith continuously along said fiber to form at least one electric or electronic component or a conductor;

the network being electrically connected to an electrically conducting interface component for electric communication with an external electric component or circuitry.

3. (Twice Amended) A network according to Claim 1, comprising at least two nucleotide fibers connected to one another at a junction in which one nucleotide segment of one fiber is bound to another nucleotide segment of another fiber by a sequence-specific interaction.

4. (Twice Amended) A network according to Claim 1, comprising a junction between a first nucleotide ~~chain of one~~ fiber and a second nucleotide ~~chain of another~~ fiber, formed by a molecule, cluster of atoms or molecules or a particle bound to each of the nucleotide ~~chains~~fibers.

7. (Amended) A network according to Claim 6, wherein the chemically modified nucleotides are included in the network:

(i) in junction between nucleotide fibers for binding the nucleotide fibers to one another,

(ii) in junction between a nucleotide fiber and a linker that binds a nucleotide fiber to an electronic component of the network, or

(iii) in junction between a nucleotide fiber or an electronic component and an interface component.

10. (Twice Amended) A network according to Claim 1, having

(a) at least one conductor being a wire constructed on a nucleotide fiber comprising at least one nucleic acid chain;

(b) at least one electronic component being electrically connected to said at least one wire and being constructed either on a nucleic acid chain which has been chemically or physically modified by depositing one or more molecules, cluster of atoms or molecules or particles thereon, or being constructed by a molecule, cluster of atoms or molecules or a particle situated at a junction between two or more nucleic acid chains of different fibers.

11. (Twice Amended) A network according to Claim 1, comprising two or more nucleotide fibers assembled to form the network on the basis of sequence-specific interaction of nucleic acid chains.

13. (Twice Amended) A network according to Claim 1, wherein at least one ~~nucleic acid chain~~nucleotide fiber is made electrically conductive by substances comprising a metal bound to the ~~chain~~ nucleotide fiber or portion thereof.

14. (Twice Amended) A network according to Claim 1, wherein the network comprises at least one wire formed by non-metallic conducting substance bound to a nucleotide fiber or portion thereof.

15. (Twice Amended) A network according to Claim 1, wherein at least one nucleotide fiber has at least a portion bound to semi-conducting substances.

17. (Twice Amended) A network according to Claim 1, wherein one of two adjacent portions of at least one nucleotide fiber are bound to a p-type semi-conducting substance and the other to an n-type semi-conducting substance, whereby the two adjacent portions of the nucleotide fiber constitute a p/n junction.

19. (Twice Amended) A network according to Claim 1, comprising at least one nucleotide-based junction formed by hybridization of complementary sequences of nucleotide chains in at least two nucleotide fibers.

20. (Amended) A network according to Claim 19, wherein said junction is formed into bipolar transistors, comprising:

(a) a p-type semi-conducting substance bound to a first nucleotide ~~segment~~ fiber at the junction and an n-type semi-conducting substance bound to adjacent, second nucleotide ~~segment~~ fiber at both sides of the first nucleotide ~~segment~~fiber, or

(b) an n-type semi-conducting substance bound to a first nucleotide ~~segment~~ fiber at the junction and a p-type semi-conducting substance bound to adjacent, second nucleotide ~~segment~~ fiber at both sides of the first nucleotide ~~segment~~fiber.

22. (Amended) A network according to Claim 21, comprising at least two interface components, each one connected to at least one nucleotide fiber or electronic component of the network.

23. (Twice Amended) A network according to Claim 21, wherein said interface component is connected to a wire, said wire comprising a nucleotide fiber ~~having one or more nucleotide chains~~.

24. (Amended) A network according to Claim 23, wherein the nucleotide fiber has a nucleotide end segment, and is bound to the interface component by a specific interaction with a complexing agent bound to a linker attached to the interface component.

26. (Twice Amended) A network according to Claim 21, wherein said interface component is bound to a nucleotide ~~chain~~ fiber that is bound to an electronic component of the network.

28. (Amended) A method for making an electronic network, comprising:

(a) providing an arrangement comprising at least one electrically conductive interface component;

(b) attaching a linker to the at least one interface component;

(c) contacting said arrangement with at least one nucleotide fiber ~~comprising at least one nucleotide chain~~ with a sequence capable of binding to the linker, and permitting binding of said sequences to said linker,

(d) electrically or electronically functionalizing the at least one nucleotide ~~chain~~ fiber by depositing thereon or complexing thereto at least one substance or particles.

29. (Amended) A method according to Claim 28, wherein the network is formed by self-assembly as a result of chemical complementary and molecular recognition properties of at least one nucleotide ~~chain~~ fiber to at least one other nucleotide ~~chain~~ fiber or between at least one nucleotide ~~chain~~ fiber and at least one specific sequence or domain-recognizing complexing agent.

30. (Twice Amended) A method according to Claim 28, comprising mixing nucleotide fibers and components together and allowing them to self-assemble into a network by means of specific molecule interactions.

31. (Twice Amended) A method according to Claim 28, comprising forming junctions between nucleotide ~~chains~~ fibers and at least one molecule, cluster of atoms or molecules or particles, said molecule clusters or particles serving as an electronic component in the network.